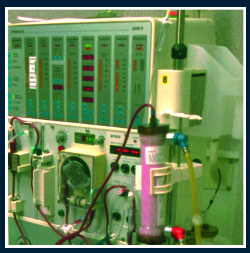
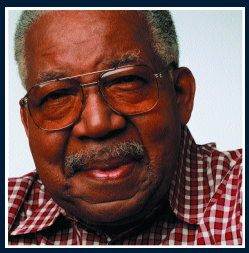


Treatment Methods for Kidney Failure

HEMODIALYSIS



Treatment Methods for Kidney Failure

HEMODIALYSIS

NIDDK
National Institutes of Health
National Institute of Diabetes and Digestive and Kidney Diseases

Contents

Introduction

Hemodialysis is the most common method used to treat advanced and permanent kidney failure. Since the 1960s, when hemodialysis first became a practical treatment for kidney failure, we've learned much about how to make hemodialysis treatments more effective and minimize side effects. But even with better procedures and equipment, hemodialysis is still a complicated and inconvenient therapy that requires a coordinated effort from your whole health care team, including your nephrologist, dialysis nurse, dialysis technician, dietitian, and social worker. But the most important members of your health care team are you and your family. By learning about your treatment, you can work with your health care team to give yourself the best possible results, and you can lead a full, active life.

When Your Kidneys Fail

Healthy kidneys clean your blood by removing excess fluid, minerals, and wastes. They also make hormones that keep your bones strong and your blood healthy. When your kidneys fail, harmful wastes build up in your body, your blood pressure may rise, and your body may retain excess fluid and not make enough red blood cells. When this happens, you need treatment to replace the work of your failed kidneys.

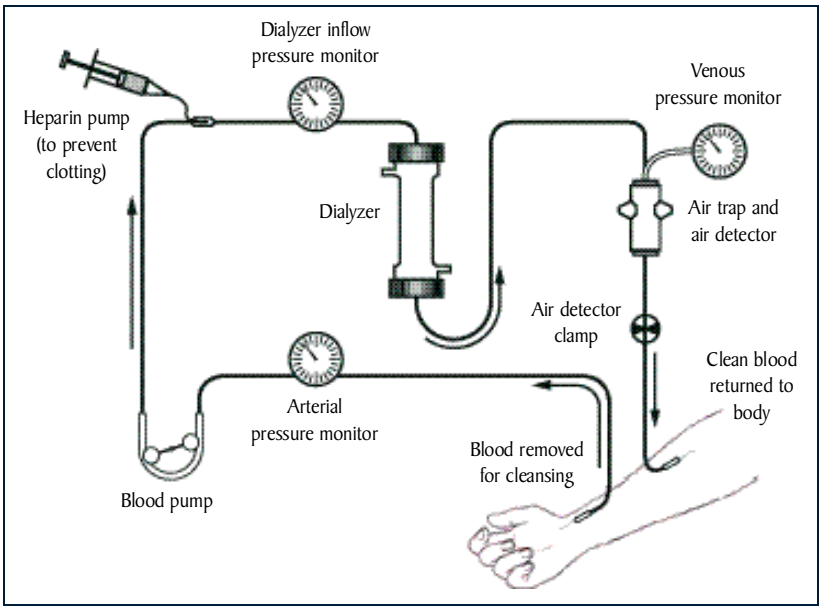
How Hemodialysis Works

In hemodialysis, your blood is allowed to flow, a few ounces at a time, through a machine with a special filter that removes wastes and extra fluids. The clean blood is then returned to

your body. Removing the harmful wastes and extra salt and fluids helps control your blood pressure and keep the proper balance of chemicals like potassium and sodium in your body.

One of the biggest adjustments you must make when you start hemodialysis treatments is following a rigid schedule. Most patients go to a clinic—a dialysis center—three times a week for 3 to 5 or more hours each visit. For example, you may be on a Monday-Wednesday-Friday schedule or a Tuesday-Thursday-Saturday schedule. You may be asked to choose a morning, afternoon, or evening shift, depending on availability and capacity at the dialysis unit. Your dialysis center will explain your options for scheduling regular treatments.

A few centers teach people how to perform their own hemodialysis treatments at home. A family member or friend who will be your helper must also take the training, which usually takes at least 4 to 6 weeks. Home dialysis gives you



Hemodialysis.

a little more flexibility in your dialysis schedule, but a regular schedule is still important. With home hemodialysis, the time for each session and the number of sessions per week may vary.

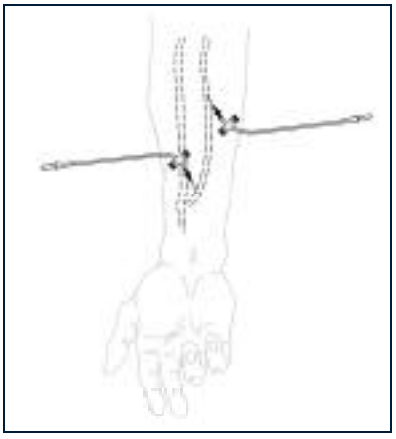
Adjusting to Changes

Even in the best situations, adjusting to the effects of kidney failure and the time you spend on dialysis can be difficult. Aside from the "lost time," you may have less energy. You may need to make changes in your work or home life, giving up some activities and responsibilities. Keeping the same schedule you kept when your kidneys were working can be very difficult now that your kidneys have failed. Accepting this new reality can be very hard on you and your family. A counselor or social worker can help you cope.

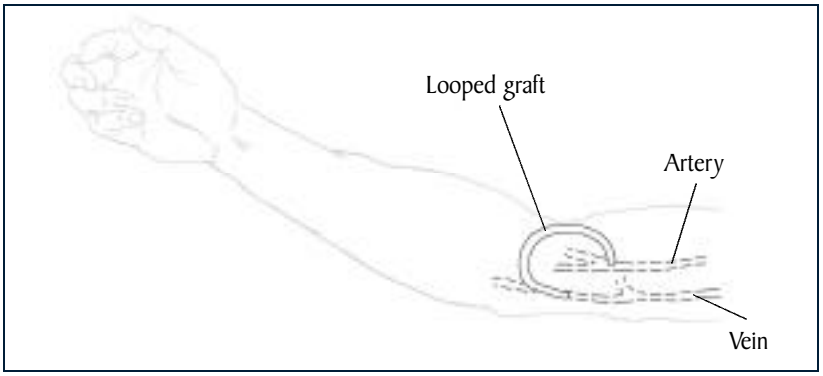
Many patients feel depressed when starting dialysis, or after several months of treatment. If you feel depressed, you should talk with your social worker, nurse, or doctor because this is a common problem that can often be treated effectively.

Getting Your Vascular Access Ready

One important step before starting hemodialysis is preparing a vascular access, a site on your body from which your blood is removed and returned. A vascular access should be



Arteriovenous fistula.



Graft.

prepared weeks or months before you start dialysis. It will allow easier and more efficient removal and replacement of your blood with fewer complications. For more information about the different kinds of vascular accesses and how to care for them, see the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) fact sheet *Vascular Access for Hemodialysis*.

Equipment and Procedures

When you first visit a hemodialysis center, it may seem like a complicated mix of machines and people. But once you learn how the procedure works and become familiar with the equipment, you'll be more comfortable.

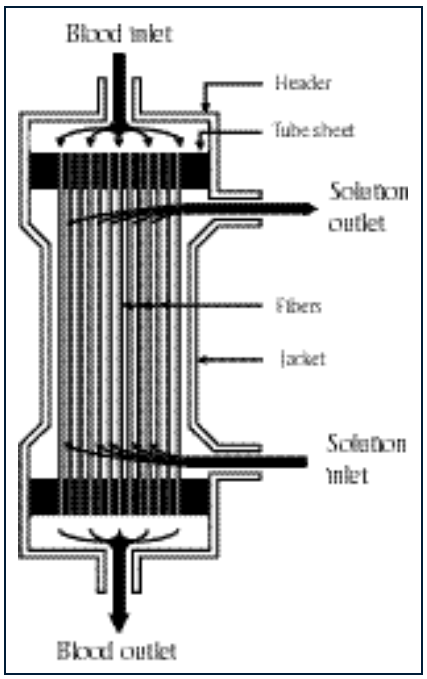
Dialysis Machine

The dialysis machine is about the size of a large television. This machine has three main jobs:

- Pump blood and monitor flow for safety.
- Clean wastes from blood.
- Monitor your blood pressure and the rate of fluid removal from your body.

Dialyzer

The dialyzer is a large canister containing thousands of small fibers through which your blood is passed. Dialysis solution, the cleansing fluid, is pumped around these fibers. The fibers allow wastes and extra fluids to pass from your blood into the solution, which carries them away. The dialyzer is sometimes called an artificial kidney.



Structure of a typical hollow fiber dialyzer.

- **Reuse.** Your dialysis center may use the same dialyzer more than once for your treatments. Reuse is considered safe as long as the dialyzer is cleaned and disinfected before each use. The dialyzer is tested each time to make sure it's still working, and it should never be used for anyone but you. Before each session, you should be sure that the dialyzer is labeled with your name and check to see that it has been cleaned, disinfected, and tested.
- **High flux/high efficiency.** In recent years, dialysis researchers have developed dialyzers with membranes that allow more rapid filtering of wastes and fluid. High-flux or high-efficiency dialysis allows for more complete and efficient removal of wastes and fluids. To keep your blood pressure from going too low, your dialysis team will need to watch carefully to make sure that fluid isn't removed from your body too quickly.

These responses aren't usually dangerous, and many people have reported that high-flux dialysis, by removing more waste within a shorter time period, helps them feel better.

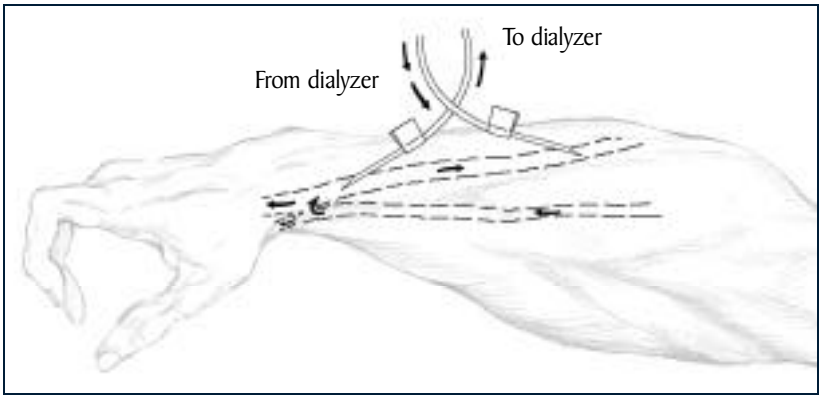
Dialysis Solution

Dialysis solution, also known as dialysate, is the fluid in the dialyzer that helps remove wastes and extra fluid from your blood. It contains chemicals that make it act like a sponge. Your doctor will prescribe a specific dialysate for your treatments. This formula can be adjusted based on how well you tolerate the treatments and on your blood tests.

Needles

Many people find the needle sticks to be one of the most unpleasant parts of hemodialysis treatments. Most people, however, report getting used to them after a few sessions. If you find the needle insertion painful, an anesthetic cream or spray can be applied to the skin.

Most dialysis centers use two needles—one to carry blood to the dialyzer and one to return the cleaned blood to your body. Some specialized needles are designed with two openings for



Arterial and venous needles.

two-way flow of blood, but these needles are less efficient and require longer sessions. Needles for high-flux or high-efficiency dialysis need to be a little larger than those used with regular dialyzers.

Some people prefer to insert their own needles. You'll need insertion training to learn how to prevent infection and protect your vascular access. You may also learn a "ladder" strategy for needle placement in which you "climb" up the entire length of the access session by session so that you don't weaken an area with a grouping of needle sticks. An alternative approach is the "buttonhole" strategy in which you use a limited number of sites but insert the needle precisely into the same hole made by the previous needle stick. Whether you insert your own needles or not, you should know these techniques to better care for your access.

Tests To See How Well Your Dialysis Is Working

About once a month, your dialysis care team will test your blood by using one of two formulas—URR or Kt/V—to see whether your treatments are removing enough wastes. Both tests look at one specific waste product, called blood urea nitrogen (BUN), as an indicator for the overall level of waste products in your system. For more information about these measurements, see the NIDDK fact sheet *Hemodialysis Dose and Adequacy*.

Conditions Related to Kidney Failure and Their Treatments

Your kidneys do much more than remove wastes and extra fluid. They also make hormones and balance chemicals in your system. When your kidneys stop working, you may have problems with anemia and conditions that affect your bones, nerves, and skin. Some of the more common conditions caused by kidney failure are fatigue, bone problems, joint problems, itching, and "restless legs."

Anemia and Erythropoietin (EPO)

Anemia is a condition in which the volume of red blood cells is low. Red blood cells carry oxygen to cells throughout the body. Without oxygen, cells can't use the energy from food, so someone with anemia may tire easily and look pale. Anemia can also contribute to heart problems.

Anemia is common in people with kidney disease because the kidneys produce the hormone erythropoietin, or EPO, which stimulates the bone marrow to produce red blood cells. Diseased kidneys often don't make enough EPO, and so the bone marrow makes fewer red blood cells. EPO is available commercially and is commonly given to patients on dialysis.

For more information about the causes of and treatments for anemia in kidney failure, see the NIDDK fact sheet *Anemia in Kidney Disease and Dialysis*.

Renal Osteodystrophy

The term "renal" describes things related to the kidneys. Renal osteodystrophy, or bone disease of kidney failure, affects 90 percent of dialysis patients. It causes bones to become thin and weak or malformed and affects both children and adults. Symptoms can be seen in growing children

with kidney disease even before they start dialysis. Older patients and women who have gone through menopause are at greater risk for this disease.

For more information about the causes of this bone disease and its treatment in dialysis patients, see the NIDDK fact sheet *Renal Osteodystrophy*.

Itching (Pruritus)

Many people treated with hemodialysis complain of itchy skin, which is often worse during or just after treatment. Itching is common even in people who don't have kidney disease; in kidney failure, however, itching can be made worse by uremic toxins that current dialyzer membranes can't remove from the blood. The problem can also be related to high levels of parathyroid hormone (PTH). Some people have found dramatic relief after having their parathyroid glands removed. But a cure that works for everyone has not been found. Phosphate binders seem to help some people; others find relief after exposure to ultraviolet light. Still others improve with EPO shots. A few antihistamines (Benadryl, Atarax, Vistaril) have been found to help; also, capsaicin cream applied to the skin may relieve itching by deadening nerve impulses. In any case, taking care of dry skin is important. Applying creams with lanolin or camphor may help.

Sleep Disorders

Patients on dialysis often have insomnia, and some people have a specific problem called the sleep apnea syndrome. Episodes of apnea are breaks in breathing during sleep. Over time, these sleep disturbances can lead to "day-night reversal" (insomnia at night, sleepiness during the day), headache, depression, and decreased alertness. The apnea may be related to the effects of advanced kidney failure on the control of

breathing. Treatments that work with people who have sleep apnea, whether they have kidney failure or not, include losing weight, changing sleeping position, and wearing a mask that gently pumps air continuously into the nose (nasal continuous positive airway pressure, or CPAP).

Many people on dialysis have trouble sleeping at night because of aching, uncomfortable, jittery, or "restless" legs. You may feel a strong impulse to kick or thrash your legs. Kicking may occur during sleep and disturb a bed partner throughout the night. Theories about the causes of this syndrome include nerve damage and chemical imbalances.

Moderate exercise during the day may help, but exercising a few hours before bedtime can make it worse. People with restless leg syndrome should reduce or avoid caffeine, alcohol, and tobacco; some people also find relief with massages or warm baths. A class of drugs called benzodiazepines, often used to treat insomnia or anxiety, may help as well. These prescription drugs include Klonopin, Librium, Valium, and Halcion. A newer and sometimes more effective therapy is Sinemet (levodopa), a drug used to treat Parkinson's disease.

Sleep disorders may seem unimportant, but they can impair your quality of life. Don't hesitate to raise these problems with your nurse, doctor, or social worker.

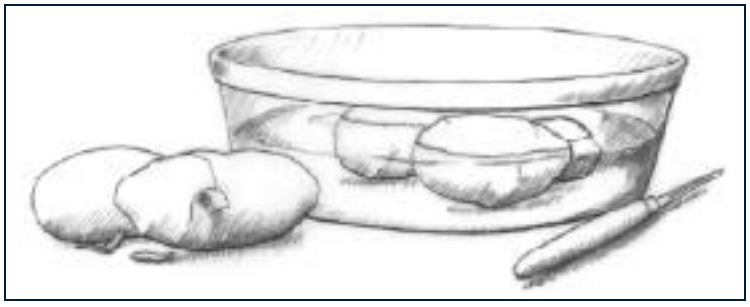
Amyloidosis

Dialysis-related amyloidosis (DRA) is common in people who have been on dialysis for more than 5 years. DRA develops when proteins in the blood deposit on joints and tendons, causing pain, stiffness, and fluid in the joints, as is the case with arthritis. Working kidneys filter out these proteins, but dialysis filters are not as effective. For more information, see the NIDDK fact sheet *Amyloidosis and Kidney Disease*.

How Diet Can Help

Eating the right foods can help improve your dialysis and your health. Your clinic has a dietitian to help you plan meals. Follow the dietitian's advice closely to get the most from your hemodialysis treatments. Here are a few general guidelines.

- **Fluids.** Your dietitian will help you determine how much fluid to drink each day. Extra fluid can raise your blood pressure, make your heart work harder, and increase the stress of dialysis treatments. Remember that many foods—such as soup, ice cream, and fruits—contain plenty of water. Ask your dietitian for tips on controlling your thirst.
- **Potassium.** The mineral potassium is found in many foods, especially fruits and vegetables. Potassium affects how steadily your heart beats, so eating foods with too much of it can be very dangerous to your heart. To control potassium levels in your blood, avoid foods like oranges, bananas, tomatoes, potatoes, and dried fruits. You can remove some of the potassium from potatoes and other vegetables by peeling and soaking them in a large container of water for several hours, then cooking them in fresh water.



You can remove some potassium from potatoes by soaking them in water.

- **Phosphorus.** The mineral phosphorus can weaken your bones and make your skin itch if you consume too much. Control of phosphorus may be even more important than calcium itself in preventing bone disease and related complications. Foods like milk and cheese, dried beans, peas, colas, nuts, and peanut butter are high in phosphorus and should be avoided. You'll probably need to take a phosphate binder with your food to control the phosphorus in your blood between dialysis sessions.
- **Salt (sodium chloride).** Most canned foods and frozen dinners contain high amounts of sodium. Too much of it makes you thirsty, and when you drink more fluid, your heart has to work harder to pump the fluid through your body. Over time, this can cause high blood pressure and congestive heart failure. Try to eat fresh foods that are naturally low in sodium, and look for products labeled "low sodium."
- **Protein.** Before you were on dialysis, your doctor may have told you to follow a low-protein diet to preserve kidney function. But now you have different nutritional priorities. Most people on dialysis are encouraged to eat as much high-quality protein as they can. Protein helps you keep muscle and repair tissue, but protein breaks down into urea (blood urea nitrogen, or BUN) in your body. Some sources of protein, called high-quality proteins, produce less waste than others. High-quality proteins come from meat, fish, poultry, and eggs. Getting most of your protein from these sources can reduce the amount of urea in your blood.
- **Calories.** Calories provide your body with energy. Some people on dialysis need to gain weight. You may need to find ways to add calories to your diet. Vegetable oils—like olive, canola, and safflower oils—

are good sources of calories and do not contribute to problems controlling your cholesterol. Hard candy, sugar, honey, jam, and jelly also provide calories and energy. ***If you have diabetes, however, be very careful about eating sweets. A dietitian's guidance is especially important for people with diabetes.***

- **Supplements.** Vitamins and minerals may be missing from your diet because you have to avoid so many foods. Dialysis also removes some vitamins from your body. Your doctor may prescribe a vitamin and mineral supplement designed specifically for people with kidney failure. Take your prescribed supplement after treatment on the days you have hemodialysis. ***Never take vitamins that you can buy off the store shelf, since they may contain vitamins or minerals that are harmful to you.***

You can also ask your dietitian for recipes and titles of cookbooks for patients with kidney disease. Following the restrictions of a diet for kidney disease might be hard at first, but with a little creativity, you can make tasty and satisfying meals. For more information, see the NIDDK booklet *Eat Right To Feel Right on Hemodialysis*.

Financial Issues

Treatment for kidney failure is expensive, but Federal health insurance plans pay much of the cost, usually up to 80 percent. Often, private insurance or State programs pay the rest. Your social worker can help you locate resources for financial assistance. For more information, see the NIDDK fact sheet *Financial Help for Treatment of Kidney Failure*.

Hope Through Research

NIDDK, through its Division of Kidney, Urologic, and Hematologic Diseases, supports several programs and studies devoted to improving treatment for patients with progressive kidney disease and permanent kidney failure, including patients on hemodialysis.

- **The End-Stage Renal Disease Program** promotes research to reduce medical problems from bone, blood, nervous system, metabolic, gastrointestinal, cardiovascular, and endocrine abnormalities in kidney failure and to improve the effectiveness of dialysis and transplantation. The research focuses on reusing hemodialysis membranes and on using alternative dialyzer sterilization methods; on devising more efficient, biocompatible membranes; on refining high-flux hemodialysis; and on developing criteria for dialysis adequacy. The program also seeks to increase kidney graft and patient survival and to maximize quality of life.
- **The HEMO Study** is a multicenter clinical trial testing whether a higher hemodialysis dose and/or high-flux membranes will reduce patient mortality (death) and morbidity (medical problems). The full-scale phase of the trial began in July 1994 with a data center and 15 clinical sites.
- **The U.S. Renal Data System (USRDS)** collects, analyzes, and distributes information about the use of dialysis and transplantation to treat kidney failure in the United States. The USRDS is funded directly by NIDDK in conjunction with the Health Care Financing Administration. The USRDS publishes an *Annual Data Report*, which characterizes the total population of people being treated for kidney failure; reports on incidence, prevalence, mortality rates, and trends over time;

and develops data on the effects of various treatment modalities. The report also helps identify problems and opportunities for more focused special studies of renal research issues.

- **The Hemodialysis Vascular Access Clinical Trials Consortium** will conduct a series of multicenter, randomized, placebo-controlled clinical trials of drug therapies to reduce the failure and complication rate of arteriovenous grafts and fistulas in hemodialysis. Recently developed antithrombotic agents and drugs to inhibit cytokines may be evaluated in these large clinical trials.

Resources

Organizations That Can Help

American Association of Kidney Patients
100 South Ashley Drive
Suite 280
Tampa, FL 33602
Phone: 1–800–749–2257 or (813) 223–7099
Email: AAKPnat@aol.com
Internet: www.aakp.org

American Kidney Fund
6110 Executive Boulevard
Suite 1010
Rockville, MD 20852
Phone: 1–800–638–8299 or (301) 881–3052
Email: helpline@akfinc.org
Internet: www.akfinc.org

Life Options Rehabilitation Program
603 Science Drive
Madison, WI 53711–1074
Phone: 1–800–468–7777 or (608) 232–2333
Email: lifeoptions@medmed.com
Internet: www.lifeoptions.org

National Kidney Foundation, Inc.
30 East 33rd Street
New York, NY 10016
Phone: 1–800–622–9010 or (212) 889–2210
Email: info@kidney.org
Internet: www.kidney.org

Additional Reading

If you would like to learn more about kidney failure and its treatment, you may be interested in reading

AAKP Patient Plan
This is a series of booklets and newsletters that cover the different phases of learning about kidney failure, choosing a treatment, and adjusting to changes.
American Association of Kidney Patients
100 South Ashley Drive
Suite 280
Tampa, FL 33602
Phone: 1–800–749–2257 or (813) 223–7099
Email: AAKPnat@aol.com
Internet: www.aakp.org

***Getting the Most From Your Treatment* series**
This is a series of brochures based on the National Kidney Foundation's Dialysis Outcomes Quality Initiative (NKF–DOQI). Titles include *What You Need To Know About*

Peritoneal Dialysis, What You Need To Know Before Starting Dialysis, and *What You Need To Know About Anemia.* Additional patient education brochures include information on diet, work, and exercise.

National Kidney Foundation, Inc.
30 East 33rd Street
New York, NY 10016
Phone: 1–800–622–9010 or (212) 889–2210
Email: info@kidney.org
Internet: www.kidney.org

Kidney Disease: A Guide for Patients and Their Families
American Kidney Fund
6110 Executive Boulevard
Suite 1010
Rockville, MD 20852
Phone: 1–800–638–8299 or (301) 881–3052
Email: helpline@akfinc.org
Internet: www.akfinc.org

Medicare Coverage of Kidney Dialysis and Kidney Transplant Services: A Supplement to Your Medicare Handbook
Publication Number HCFA–10128
U.S. Department of Health and Human Services
Health Care Financing Administration
7500 Security Boulevard
Baltimore, MD 21244–1850
Phone: 1–800–MEDICARE (1–800–633–4227)
TDD: 1–877–486–2048
Internet: www.medicare.gov/Publications/English.asp

Newsletters and Magazines

Family Focus Newsletter (published quarterly)
National Kidney Foundation, Inc.
30 East 33rd Street
New York, NY 10016
Phone: 1–800–622–9010 or (212) 889–2210
Email: info@kidney.org
Internet: www.kidney.org

For Patients Only (published six times a year)
ATTN: Subscription Department
18 East 41st Street
20th Floor
New York, NY 10017–6222

Renalife (published quarterly)
American Association of Kidney Patients
100 South Ashley Drive
Suite 280
Tampa, FL 33602
Phone: 1–800–749–2257 or (813) 223–7099
Email: AAKPnat@aol.com
Internet: www.aakp.org

Acknowledgments

The National Institute of Diabetes and Digestive and Kidney Diseases thanks these dedicated health professionals for their careful review of this publication.

Richard A. Sherman, M.D.
Robert Wood Johnson Medical School

Richard D. Swartz, M.D.
University of Michigan Health System

Charlie Thomas, A.C.S.W., C.I.S.W.
Samaritan Transplant Services, Phoenix, AZ

The individuals listed here facilitated field testing for this publication. NIDDK thanks them for their contribution.

Kim Bayer, M.A., R.D., L.D.
BMA Dialysis
Bethesda, MD

Cora Benedicto, R.N.
Clinic Director
Gambro Health Care
N Street Clinic
Washington, DC

National Kidney and Urologic Diseases Information Clearinghouse

3 Information Way
Bethesda, MD 20892–3580
Phone: 1–800–891–5390 or (301) 654–4415
Fax: (301) 907–8906
Email: nkudic@info.niddk.nih.gov

The National Kidney and Urologic Diseases Information Clearinghouse (NKUDIC) is a service of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). NIDDK is part of the National Institutes of Health under the U.S. Department of Health and Human Services. Established in 1987, the clearinghouse provides information about diseases of the kidneys and urologic system to people with kidney and urologic disorders and to their families, health care professionals, and the public. NKUDIC answers inquiries; develops and distributes publications; and works closely with professional and patient organizations and Government agencies to coordinate resources about kidney and urologic diseases.

Publications produced by the clearinghouse are carefully reviewed by both NIDDK scientists and outside experts.

This booklet is also available under "Health Information" at *www.niddk.nih.gov* on the Internet.

About the Kidney Failure Series

You and your doctor will work together to choose a treatment that's best for you. The booklets and fact sheets of the NIDDK Kidney Failure Series can help inform you about the specific issues you will face.

Booklets

- *Kidney Failure: Choosing a Treatment That's Right for You*
- *Treatment Methods for Kidney Failure: Hemodialysis*
- *Treatment Methods for Kidney Failure: Peritoneal Dialysis*
- *Treatment Methods for Kidney Failure: Transplantation*
- *Eat Right To Feel Right on Hemodialysis*
- *Kidney Failure Glossary*

Fact Sheets

- *Vascular Access for Hemodialysis*
- *Hemodialysis Dose and Adequacy*
- *Peritoneal Dialysis Dose and Adequacy*
- *Amyloidosis and Kidney Disease*
- *Anemia in Kidney Disease and Dialysis*
- *Renal Osteodystrophy*
- *Financial Help for Treatment of Kidney Failure*

Learning as much as you can about your treatment will help make you an important member of your health care team.

NIDDK will develop additional materials for this series as needed. Please address any comments about this series and requests for copies to the National Kidney and Urologic Diseases Information Clearinghouse. This series is also on the NIDDK web site at *www.niddk.nih.gov;* click on "Kidney" under Health Information.

U.S. Department of Health and Human Services
National Institutes of Health

NIDDK
National Institute of Diabetes and Digestive and Kidney Diseases
NIH Publication No. 01–4666
April 2001